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Patent Application of:
Nelson et al.

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For: NETWORKED ELECTRONIC ORDNANCE
SYSTEM

Examiner: T. Chambers

REPLY BRIEF

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Commissioner for Patents
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Madam/Sir:

In accordance with 37 C.F.R. § 41.41, Applicants submit this brief in reply to the Examiner's Answer dated February 9, 2009 in the above-captioned application.

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I. STATUS OF CLAIMS

Claims 88-89 and 91-106 are pending in this application. Claims 88-89 have been withdrawn from consideration. Claims 91 and 101 are newly rejected.

More particularly, claim 91 stands newly rejected under 35 U.S.C. § 103(a) as being unpatentable over the embodiment of Figure 5 of Boucher¹ in view of the embodiment of Figure 1A of Boucher. Claim 101 stands newly rejected under 35 U.S.C. § 103(a) as being unpatentable over the embodiments of Figures 5 and 1A of Boucher in view of Shann². Appellants appeal these new rejections under 35 U.S.C. § 103(a) of claims 91 and 101.

No other rejections or objections are discussed by the Examiner in the Examiner's Answer. Accordingly, the rejections and objections set forth by the Examiner in the final Office Action dated October 30, 2007 are taken to have been withdrawn. *Ex parte Emm*, 118 USPQ 180 (Bd. App. 1957).

More particularly, the Examiner has not repeated or discussed (a) the previous objections under 37 C.F.R. 1.75(c) of claims 92, 93, 96-100 and 102-106, (b) the previous rejections under 35 U.S.C. § 112, first paragraph, of claims 91-100, (c) the previous rejections under 35 U.S.C. § 112, second paragraph, of claims 101-106, (d) the previous rejection under 35 U.S.C. § 103(a) of claims 91, 92, 94, 95 and 97 as being unpatentable over Boucher, Abouav³, and "applicant's admission," (e) the previous rejection under 35 U.S.C. § 103(a) of claim 93 as being unpatentable over Boucher, Abouav, "applicant's admission," and Shann, (f) the previous rejection under 35 U.S.C. § 103(a) of claim 96 as being unpatentable over Boucher, Abouav,

¹ U.S. Patent No. 6,584,907

² U.S. Patent No. 5,894,103

³ U.S. Patent No. 4,860,653

“applicant’s admission”, Shann, and Tyler⁴, (g) the previous rejection under 35 U.S.C. § 103(a) of claims 98-100 as being unpatentable over Boucher, Abouav, “applicant’s admission,” and Tyler, (h) the previous rejections under 35 U.S.C. § 103(a) of claims 101-103 as being unpatentable over Boucher, Abouav, and Shann, (i) the previous rejections under 35 U.S.C. § 103(a) of claims 104-106 as being unpatentable over Boucher, Abouav, Shann, and Tyler, and (j) the previous rejection under 35 U.S.C. § 102(f) of claims 91-106.

⁴ U.S. Patent No. 4,674,047

II. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The new rejection of claim 91 under 35 U.S.C. § 103(a) as being unpatentable over the embodiment of Figure 5 of Boucher in view of the embodiment of Figure 1A of Boucher. (See, the Examiner's Answer, pages 10-12.)
2. The new rejection of claim 101 under 35 U.S.C. § 103(a) as being unpatentable over the embodiments of Figures 5 and 1A of Boucher in view of Shann. (See, the Examiner's Answer, pages 12-13.)

III. ARGUMENTS

Boucher and Shann, whether considered individually or in combination, fail to disclose or suggest significant inventive features expressly recited in claims 91 and 101, and furthermore, Shann teaches against the combination with Boucher that the Examiner asserts in the Examiner's Answer. Accordingly, the Section 103 rejections in the Examiner's Answer cannot be sustained for at least any of the following reasons.

A. Response to the Section 103 Rejection of Claim 91 (Boucher)

Claim 91 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of the embodiment of Figure 5 of Boucher in view of the embodiment of Figure 1A of Boucher. For at least the reasons explained below, independent claim 91 is patentable over these embodiments of Boucher, whether considered individually or in combination.

1. Claim 91 Is Directed To A Networked Electronic Ordnance System That Includes (I) A Bus Controller that Transmits A Digital Arming Command Onto A Network And Alters An Analog Condition Of The Network To Correspond To The Firing Command And (Ii) At Least One Pyrotechnic Device Having A Logic Device, Where The Pyrotechnic Device Fires Upon Detecting A Firing Command Having A Unique Identifier Associated With The Logic Device And Also Determining That The Analog Condition Of The Network Corresponds To The Received Firing Command

Claim 91 is directed toward a networked electronic ordnance system. An embodiment of such a system includes a bus controller connected to a network and a plurality of pyrotechnic devices connected by the network to the bus controller. Examples of these features are disclosed in the specification at page 4, line 20, to page 5, line 2, page 6, lines 1-9 and 14-19, and page 7, lines 3-5, as well as Figure 2. Specifically, Figure 2 depicts a bus controller 206 (See, e.g., accompanying description at page 5, line 2), a cable network 204 (See, e.g., accompanying description at page 4, line 22), and a plurality of pyrotechnic devices 202 (See, e.g., page 4, line 22).

The bus controller transmits onto the network digital arming commands using at least one unique identifier (See, e.g., page 10, lines 9-19, and page 16, lines 8-10, as well as Figure 4, element 404), and transmits onto the network a digital firing command

using at least one unique identifier (See, e.g., page 18, lines 18-19, and page 19, lines 12-21, as well as Figure 4, element 412). The bus controller also alters an analog condition of the network to correspond to a firing command (See, e.g., page 19, lines 2-9, as well as Figure 4, element 412).

At least one of the pyrotechnic devices includes a bus interface for sensing the analog condition of the network (See, e.g., page 7, lines 11-13, and page 19, lines 5-11, as well as Figure 3, element 312), a capacitor for storing activation energy (See, e.g., page 7, lines 19-20, and page 8, lines 4-14, as well as Figure 3, element 302), an initiator (See, e.g., page 7, line 20, to page 8, line 3, as well as Figure 3, element 304), and a logic device. The logic device, which has a unique identifier, stores activation energy in the capacitor upon receiving a digital arming command that includes the unique identifier of its logic device (See, e.g., page 9, line 13, to page 10, line 8, and page 16, lines 12-21, as well as Figure 3, element 300). Once armed, the logic device releases the stored activation energy from the capacitor into the initiator upon (1) detecting that a digital firing command is received that includes its unique identifier, and also (2) determining that the bus interface senses that the analog condition of the network corresponds to the received firing command (See, e.g., page 20, lines 1-9, as well as Figure 4, element 414).

Accordingly, in the networked electronic ordnance system of claim 91, an armed pyrotechnic device fires only in response to at least two distinct events, one digital (i.e., the firing command) and one analog (i.e., an alter analog condition of the network), both originating from the bus controller.

2. Boucher Discloses Use Of An External Sensor 18a And An Internal Sensor 56 In An Ordnance System For De-Centralized Firing Control

Boucher is directed to an ordnance system including a control unit, one or more effectors (detonators, initiators, shaped charges and the like), and a two-, three- or four-wire communication bus between the control unit and the effectors (See, Boucher's Abstract, lines 1-5). Boucher discloses an addressable system in which all the effectors can be connected to the same communication bus and the control unit can issue coded

signals on the bus addressed to a specific effector (See, Boucher's Abstract, lines 5-8). Boucher teaches and discloses "de-centralization of firing control so that the control unit does not have exclusive control over whether the effectors function" (See, Boucher's Abstract, lines 14-16). As a result, "the individual effectors possess decision-making ability" (See, Boucher's Abstract, lines 16-17). To participate in the decision-making process, these so-called "intelligent effectors" may be equipped with sensors or other diagnostic circuitry whose condition is checked for satisfactory output before functioning is permitted to occur (See, Boucher's Abstract, lines 19-23).

Figure 5 of Boucher shows a schematic block diagram of an initiator 16c joined to a party line bus 14 for receiving signals from a firing control system via the bus 14 (See, Boucher at column 15, lines 46-49). Figure 5 does not show a firing control system, however, Figure 1A of Boucher shows a firing control system 12 joined to a communication bus 14 (See, Boucher at column 15, lines 58-63). A signal that meets the requirements of a buffer provided by EMI filter 44, isolators 46 and clamp 48 is then conveyed to an arming switch 28, a power supply circuit 50, and a data communication circuit 52 (See, Boucher at column 15, lines 58-61). An initiator control circuit 54 receives input from the data communication circuit 52 and power supply 50, as well as status information from an energy storage device, e.g., a firing capacitor 26, and an initiation element, e.g., semiconductor bridge 42a (See, Boucher at column 15, lines 61-65).

When the proper input signals are received from these sources, initiator control circuit 54 may issue an arming signal (See, Boucher at column 15, lines 65-67). Figure 5 shows that the arming signal is received by a logic gate 54a, which also receives input from an internal sensor 56 (See, Boucher at column 16, lines 1-2). If the output of internal sensor 56 is appropriate for the operation of arming switch 28, logic gate 54a may convey the control arming signal from control circuit 54 to arming switch 28, through which a charging voltage may be applied to the firing capacitor 26 (See, Boucher at column 16, lines 2-7).

Figure 5 also shows a logic gate 54b that compares the control firing signal to the output of an environmental sensor 18a and only conveys the control firing signal to the firing switch when the environmental sensor 18a indicates that conditions are appropriate for firing (See, Boucher at column 16, lines 17-22). Closing a firing switch 58 permits the discharge of firing capacitor 26 through the semiconductor bridge 42a or other initiation element, thus initiating the device (See, Boucher at column 16, lines 22-24). In addition to providing input to logic gates 54a and 54b, internal sensor 56 and external sensor 18a may provide signals directly to initiator control circuit 54 and/or data communication circuit 52 so that initiator 16c can perform a self-test for readiness prior to the receipt of an arming or firing signal from party line bus 14 (See, Boucher at column 16, lines 25-30).

3. Boucher Fails To Disclose Or Suggest, *Inter Alia*, A Bus Controller That Alters An Analog Condition Of The Network To Correspond To A Firing Command, And Then, In A Pyrotechnic Device, A Bus Interface Sensing The Analog Condition Of A Network And A Logic Device That Stores Activation Energy In A Capacitor And Releases The Stored Activation Energy From The Capacitor Upon (1) Detecting A Firing Command Is Received And Also (2) Determining That The Bus Interface Senses That The Analog Condition Of The Network Corresponds To The Received Firing Command

Claim 91 is patentable over the embodiment of Figure 5 of Boucher because this reference fails to teach or disclose at least two significant features of claim 91. The first feature that Boucher fails to teach or disclose is a bus interface that senses the analog condition of a *network*. The Examiner correctly acknowledges that Boucher discloses an internal sensor 56, but incorrectly asserts that internal sensor 56 is a bus interface. Support for this assertion, according to the Examiner, is that “in a general discussion of the operation of the ordnance device, the specification discloses internal sensors (22a) as being capable of sensing conditions such as *voltages, frequencies and current draw*, this qualifying element 56 as a bus interface.” However, Boucher discloses at column 12, lines 31-45, with reference to Figure 1A that:

Similarly, initiator 22 is responsive not only to signals from firing control system 12 but also to an internal sensor 22a which may sense conditions inside the initiator shell. Such internal conditions may include the

condition of the firing circuitry of initiator 22, the condition of the output charge of initiator 22, etc. Other relevant internal conditions that might be reported by sensor 22a include temperature, voltages, frequencies, current draw, initiation element continuity, etc. If a firing signal is received from firing control system 12 but the requisite signal is not received from the sensor 22a, initiator 22 may optionally be programmed to postpone firing despite the firing signal from firing control system 12. Sensor 22a may thus provide a built-in test function for manufacturing quality as well as field reliability.

Accordingly, Boucher teaches and discloses that internal sensor 22a is for sensing conditions inside the initiator 22 and therefore fails to disclose or suggest that sensor 22a senses an analog condition of the bus 14, as claimed.

There is absolutely no illustration in Figures 1A or 5 of Boucher or corresponding discussion in the specification of using either internal sensor 22a (in Figure 1A) or internal sensor 56 (in Figure 5) to sense an analog condition on the party line bus 14 itself. To the contrary, Boucher specifically teaches *against* associating the sensor 22a with the bus 14. Boucher instead teaches that the initiator 22 receives one signal from the firing control system 12 and another signal from internal sensor 22a. According to Boucher at column 11, lines 45-46:

Intelligent initiators possess initiator control circuitry having some ability to override a signal from the firing control system indicating readiness to fire, thus de-centralizing the firing decision from the firing control system. The firing signal from the firing control system then becomes one input or factor taken into account by the initiator in deciding whether to fire. Other signals bearing on the decision to fire may be derived from sensors to which the initiator is responsive.

It is respectfully submitted that Boucher teaches that the sensor 22a senses internal conditions of the initiator 16 such as temperature, voltages, frequencies, current draw, and initiation element continuity, and therefore teaches against sensing an analog condition of the bus 14, as claimed.

With regard to internal sensor 56, Boucher does not disclose or suggest that this internal sensor is generally analogous to the internal sensor 22a as asserted by the Examiner. Even if the internal sensor 56 is generally analogous to internal sensor 22a – a proposition that Appellants do not concede – Boucher's disclosure relating to

internal sensor 56 similarly fails to teach or disclose a bus interface for sensing the analog condition of the network, as claimed.

Boucher discloses with reference to Figure 5 that the internal sensor 56 and an external sensor 18a provide arming and firing inputs, respectively. An arming signal is received by a logic gate 54a which also receives input from an internal sensor 56 (See, Boucher at column 16, lines 1-2). The external sensor 18a indicates that an environmental condition is appropriate for firing (See, Boucher at column 16, lines 17-22). Boucher teaches and discloses at column 16, lines 25-30, that “[i]n addition to providing input to logic gates 54a and 54b, internal sensor 56 and external sensor 18a may provide signals directly to initiator control circuit 54 and/or data communication circuit 52 so that initiator 16c can perform a self-test for readiness prior to the receipt of an arming or firing signal from party line bus 14.”

Accordingly, for reasons generally analogous to those discussed above with respect to internal sensor 22a, it is respectfully submitted that Boucher teaches against the internal sensor 56 sensing an analog condition of the bus 14, as claimed. This is because the sensors disclosed in Boucher are for enabling de-centralized control; they are not used for interpreting a command sent along a party line bus by a bus controller. If anything, the teaching in Boucher is that the logic device may disregard the intended communication by a bus controller provided on a party line bus, based upon other communications from an internal sensor.

The second feature that Boucher fails to teach or disclose is a logic device that, *inter alia*, determines that the bus interface senses that the analog condition of the network corresponds to the received firing command. First, since Boucher fails to teach or disclose the bus interface as discussed above, it necessarily follows that Boucher fails to teach or disclose the logic device as claimed. Second, the Examiner incorrectly asserts that Boucher’s initiator control circuit 54 discloses the logic device as claimed. Support for this assertion, according to the Examiner, is that “the decision to fire is based on conditions precedent: 1) a properly coded firing signal from the bus controller ... and 2) internal and external conditions (col. 16, ll. 17-33) are received from external

sensor 18a and internal sensor 56, transferred to logic gates 54a,b which then compares the conditions to the firing signal.” As discussed above, the internal sensor 56 provides an arming, rather than a firing, input to logic gate 54a. Moreover, as also discussed above, the “*voltages, frequencies and current draw*” that the Examiner recalls are internally sensed inside the initiator 16 rather than from the party line bus 14. Accordingly, it is respectfully submitted that Boucher fails to teach or disclose a logic device that, *inter alia*, determines that the bus interface senses that the analog condition of the network corresponds to the received firing command, as claimed, and also that Boucher teaches against such a logic device.

The Examiner acknowledges that, in the embodiment of Figure 5, Boucher fails to disclose unique identifiers, and then asserts that Boucher’s Figure 1A embodiment “discloses initiator devices that are programmed to respond [to] ‘those signals that contain an address code identified with that initiator.’” The Examiner then asserts that, at the time of the invention, one having ordinary skill in the art would have found it obvious to provide the embodiment of Figure 5 with the unique address features of figure 1A – a proposition that Appellants do not concede. Regardless of the accuracy of the Examiner’s assertions, Boucher’s embodiments of Figures 5 and 1A, whether considered individually or in combination, fail to disclose or suggest each and every feature of the combination included in claim 91. More particularly, for at least the reasons discussed above with regard to internal sensors 22a and 56, Boucher fails to teach or disclose at least the bus interface and logic device included in claim 91, and also teaches against such a combination of features.

Boucher’s embodiments of Figures 5 and 1A, whether considered individually or in combination, fail to disclose or suggest a networked electronic ordnance firing system that integrates critical safety measures for controlling the firing of pyrotechnic devices in aerospace applications, such as missiles, rockets, aircraft and spacecraft. The systems recited in claim 91 provide significant technical advances over conventional systems for preventing pyrotechnic devices from firing inadvertently.

In some embodiments according to Appellants' disclosure, safety can be improved by preventing inadvertent firing. For example, the system is configured such that both digital and analog fire control conditions must be met in the logic device before a pyrotechnic device can be fired. To initiate a pyrotechnic device, the bus controller sends a first digital signal to arm the pyrotechnic device. After the pyrotechnic device is armed, the bus controller places the pyrotechnic device into a firing condition. This is performed by altering an analog condition of the network to correspond to a digital firing command. The analog condition of the bus can be altered by changing a characteristic of the electrical power transmitted across the network, such as the voltage, modulation depth or frequency. The bus controller also transmits a digital firing command signal to be received by the logic device for operating the initiator to fire the pyrotechnical device.

On the other end of a network as claimed, the designated pyrotechnic device only fires upon detecting both the altered analog condition and the digital firing command in the logic device. The pyrotechnic device includes a bus interface that can detect when the bus controller alters the analog condition of the network. Thus, if the bus interface senses the analog condition corresponding to the firing command, and the logic device detects the firing command, then the logic device operates the initiator to fire the pyrotechnic device.

The assignee of the pending patent application, PS/EMC West LLC, commercializes the claimed technology in its Smart Energetics Architecture platform of products (SEATM). As attested to in a declaration under 37 C.F.R. §1.132 submitted by Steven D. Nelson, a co-inventor and Vice President of Product Development at PS/EMC West LLC, the SEATM technology has enjoyed significant commercial success and acclaim directly as a result of the systems as claimed. This declaration was submitted concurrently with the Amendment filed on August 24, 2007, and a copy is also included in the Evidence Appendix (Section VI) of this document.

For at least any of the above reasons, it is respectfully submitted that independent claim 91 is patentable over Boucher, and that the rejection under Section 103 of claim 91 is improper and should be reversed.

B. Response to the Section 103 Rejection of Claim 101 (Boucher and Shann)

Claim 101 was rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Boucher's embodiments of Figures 5 and 1A in view of Shann. For at least the reasons explained below, independent claim 101 is patentable over Boucher and Shann, whether considered individually or in combination.

1. Claim 101 Is Directed To A Networked Electronic Ordnance System That Includes A Bus Controller And A Plurality Of Pyrotechnic Devices, The Bus Controller Transmits Digital Arming, Digital Disarming, And Digital Firing Commands Having A Unique Identifier Onto A Network, And At Least One Pyrotechnic Device Includes An Initiator And A Logic Device That Releases Stored Activation Energy Into The Initiator In Response To Receiving The Digital Firing Command And Discharges Stored Activation Energy In Response To Receiving The Digital Disarming Command, When Such Commands Include The Logic Device's Unique Identifier

Claim 101 is directed toward a networked electronic ordnance system. One embodiment of such a system includes a bus controller connected to a network and a plurality of pyrotechnic devices connected by the network to the bus controller. Examples of these features are disclosed in the specification at page 4, line 20, to page 5, line 2, page 6, lines 14-19, and page 7, lines 3-5, as well as Figure 2. Specifically, Figure 2 depicts a bus controller 206 (See, e.g., accompanying description at page 5, line 2), a cable network 204 (See, e.g., accompanying description at page 4, line 22), and a plurality of pyrotechnic devices 202 (See, e.g., page 4, line 22).

The bus controller transmits onto the network digital arming commands using at least one unique identifier (See, e.g., page 10, lines 9-19, and page 16, lines 8-10, as well as Figure 4, element 404), transmits onto the network digital disarming commands using at least one unique identifier (See, e.g., page 17, lines 17-22, as well as Figure 4, element 408), and transmits onto the network digital firing commands using at least one

unique identifier (See, e.g., page 18, lines 18-19, and page 19, lines 12-21, as well as Figure 4, element 412).

At least of the one pyrotechnic devices includes an initiator (See, e.g., page 7, line 20, to page 8, line 3, as well as Figure 3, element 304) and a logic device having a unique identifier that stores activation energy upon receiving a digital arming command that includes its unique identifier (See, e.g., page 9, line 13, to page 10, line 8, and page 16, lines 12-21, as well as Figure 3, element 300). The logic device releases the stored activation energy into its initiator when a digital firing command is received that includes its unique identifier (See, e.g., page 20, lines 1-9, as well as Figure 4, element 414). The logic device also discharges the stored activation energy when a digital disarming command is received that includes its unique identifier (See, e.g., page 17, line 17, to page 18, line 5).

2. Shann Discloses “Abort” Signals Received Simultaneously By All Of The Detonator Circuits

Shann discloses a detonator firing circuit comprising a control unit and a plurality of detonator units (See, e.g., Shann’s Abstract). The control unit transmits various signals to the detonator units to control their operation (See, e.g., Shann at column 3, lines 43-49). Among these signals are “fire” signals for detonating the detonator units, and “abort” signals for neutralizing the detonator units such that they no longer detonate upon receiving “fire” signals (See, Shann at column 3, line 57, to column 4, line 7).

3. Shann Fails to Disclose or Suggest, *inter alia*, a Logic Device that Discharges Stored Activation Energy when a Digital Disarming Command is Received that Includes a Unique Identifier

The Examiner incorrectly asserts that, at the time of the invention, one having ordinary skill in the art would have found it obvious to provide the combined device of Boucher with the “abort” feature of Shann. Shann teaches that the “abort” signal is a “type 2” signal, or in other words, a signal that is simultaneously broadcast to the plurality of detonator units (See, e.g., Shann at column 4, lines 1-7, and column 3, lines 19-28). Accordingly, Shann’s abort signal does not include a unique identifier as recited in claim 101. Because Shann fails to disclose a disarming command including a unique

identifier, the combination of Boucher and Shann asserted in the Examiner's Answer fails to disclose or suggest each feature included in claim 101.

Additionally, it is respectfully submitted that Shann teaches against the combination of Boucher and Shann asserted by the Examiner in the Examiner's Answer. The Examiner asserts in the Examiner's Answer that Figure 1A of Boucher discloses an initiator device that is programmed to respond to those signals that contain an address code identified with that initiator. However, in view of the Examiner's previous acknowledgment that Boucher does not disclose a digital disarming command, it would appear that the Examiner's Answer is asserting that Boucher provides a unique identifier in a command or signal other than a digital disarming command. In that case, it would seem that the Examiner's obviousness case relies on a tacit assumption that the presence of a unique identifier in one type of command or signal makes it obvious to include a unique identifier in all other types of commands or signals. However, as demonstrated by Shann's "type 1" signals (with identifiers) and Shann's "type 2" signals (without identifiers), it is not obvious to include a unique identifier in every signal. Accordingly, it is respectfully submitted that Shann specifically discloses and suggests using disarming signals without identifiers and firing signals that include identifiers.

Boucher's embodiments of Figures 5 and 1A and Shann, whether considered individually or in combination, also fail to disclose or suggest a networked electronic ordnance firing system that integrates critical safety measures for controlling the firing of pyrotechnic devices in aerospace applications, such as missiles, rockets, aircraft and spacecraft. The systems recited in claim 101 provide significant technical advances over conventional systems for preventing pyrotechnic devices from firing inadvertently.

In some embodiments according to Appellants' disclosure, a pyrotechnic device stores activation energy upon receiving the digital arming command that includes its unique identifier. If a digital firing command is received, the activation energy is released into the initiator to fire the pyrotechnic device. If a digital disarming command is received, the activation energy is discharged, to thereby disarm the pyrotechnic device.

As was discussed above with respect to claim 91, the declaration under 37 C.F.R. §1.132 submitted by Steven D. Nelson attests to the significant commercial success and acclaim for the SEATM technology that has directly resulted from of the systems recited in claim 101.

For at least any of the above reasons, it is respectfully submitted that independent claim 101 is patentable over Boucher and Shann, whether considered individually or in combination, and that the rejection under Section 103 of claim 101 is improper and should be reversed.

C. Dependent claims 92-100 and 102-106

Claims 92-100 depend directly or indirectly from claim 91. These dependent claims are accordingly patentable over Boucher for the same reasons as claim 91, and also for the additional subject matter of these claims.

Claims 102-106 depend from claim 101. These dependent claims are accordingly patentable over Boucher and Shann for the same reasons as claim 101, and also for the additional subject matter of these claims.

IV. CONCLUSION

Based on the foregoing remarks, Appellants respectfully submit that claims 91-106 overcome all outstanding rejections. In particular, claim 91 overcomes the corresponding rejection under 35 U.S.C. § 103(a) based on the failure of Boucher to disclose or suggest a bus interface that senses the analog condition of a network, as claimed, and the failure of the reference to disclose or suggest a logic device that, *inter alia*, determines that the bus interface senses that the analog condition of the network corresponds to the received firing command, as claimed. Claim 101 overcomes the corresponding rejection under 35 U.S.C. § 103(a) based on the failure of Boucher and Shann to teach a digital disarming command that includes a unique identifier as claimed.

Accordingly, for the reasons provided above, Appellants respectfully request reversal of the rejections of claims 91-106.

Dated: April 9, 2009

Respectfully submitted,

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V. CLAIMS APPENDIX

This section includes a copy of the claims involved in this appeal, as required by 37 C.F.R. § 41.37(c)(1)(viii).

91. A networked electronic ordnance system, comprising:

a bus controller connected to a network for (1) transmitting onto the network digital arming commands using at least one unique identifier, (2) altering an analog condition of the network to correspond to a firing command, and (3) transmitting onto the network a digital firing command using at least one unique identifier; and

a plurality of pyrotechnic devices connected by the network to the bus controller, at least one pyrotechnic device comprising:

a bus interface for sensing the analog condition of the network,
a capacitor for storing activation energy,
an initiator, and

a logic device having a unique identifier that stores activation energy in the capacitor upon receiving a digital arming command that includes the unique identifier of its logic device, and, once armed, releases the stored activation energy from the capacitor into the initiator upon (1) detecting that a digital firing command is received that includes its unique identifier, and (2) determining that the bus interface senses that the analog condition of the network corresponds to the received firing command.

92. The networked electronic ordnance system of claim 91, wherein an analog condition of the network can be its voltage level, modulation depth, or frequency.

93. The networked electronic ordnance system of claim 91, wherein the at least one pyrotechnic device discharges the stored activation energy when a digital disarming command is received that includes the unique identifier of its logic device.

94. The networked electronic ordnance system of claim 91, wherein the plurality of pyrotechnic devices are integrated into a missile.

95. The networked electronic ordnance system of claim 91, wherein the plurality of pyrotechnic devices are integrated into an aircraft.

96. The networked electronic ordnance system of claim 93, wherein after a disarming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its disarmed status over the network.

97. The networked electronic ordnance system of claim 91, wherein the bus controller generates the digital arming command.

98. The networked electronic ordnance system of claim 91, wherein after an arming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its armed status over the network.

99. The networked electronic ordnance system of claim 91, wherein the bus controller periodically queries pyrotechnic devices at regular intervals to confirm that firing capability in the device remains intact.

100. The networked electronic ordnance system of claim 91, wherein the bus controller determines network status by transmitting a network signal to one or more pyrotechnic devices and then sensing whether the signal is echoed back in response.

101. A networked electronic ordnance system, comprising:

a bus controller connected to a network for (1) transmitting onto the network digital arming commands using a least one unique identifier, (2) transmitting onto the network digital disarming commands using at least one unique identifier, and (3) transmitting onto the network digital firing commands using at least one unique identifier, and

a plurality of pyrotechnic devices connected by the network to the bus controller, at least one pyrotechnic device comprising:

an initiator, and

a logic device having a unique identifier that stores activation energy upon receiving a digital arming command that includes its unique identifier, and

(A) releases the stored activation energy into its initiator when a digital firing command is received that includes its unique identifier, and

(B) discharges the stored activation energy when a digital disarming command is received that includes its unique identifier.

102. The networked electronic ordnance system of claim 101, wherein the plurality of pyrotechnic devices are integrated into a missile.

103. The networked electronic ordnance system of claim 101, wherein the at least one pyrotechnic device includes an energy reserve capacitor for storing activation energy in the device, and the capacitor charges from current transmitted in the network upon receiving the digital arming command.

104. The networked electronic ordnance system of claim 101, wherein after a disarming command has been acted upon in the pyrotechnic device, the pyrotechnic device responds to the bus controller by transmitting its disarmed status over the network.

105. The networked electronic ordnance system of claim 101, wherein the bus controller periodically queries pyrotechnic devices at regular intervals to confirm that firing capability in the device remains intact.

106. The networked electronic ordnance system of claim 101, wherein the bus controller determines network status by transmitting a network signal to one or more pyrotechnic devices and then sensing whether the signal is echoed back in response.

VI. EVIDENCE APPENDIX

This section includes, pursuant to 37 C.F.R. § 41.37(c)(1)(ix), the Inventor's Declaration under 37 C.F.R. § 1.132 of Steven D. Nelson is duplicated on the following pages. This Inventor's Declaration was submitted concurrently with the Amendment filed on August 24, 2007.

Docket No.: 618728001US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Steven D. Nelson et al.

Confirmation No. 9079

Application No.: 09/656,325

Art Unit: 3641

Filed: September 6, 2000

Examiner: Troy Chambers

For: NETWORKED ELECTRONIC ORDNANCE
SYSTEM

INVENTOR'S DECLARATION UNDER 37 C.F.R. § 1.132

I Steven D. Nelson, declare as follows:

1. I am a co-inventor named in the above-identified patent application. I have carefully considered the Office Action dated February 27, 2007 (the "Office Action").

2. In 1981, I received a Bachelor's degree in Mechanical Engineering from the University of Southern California. Since that time, I have been employed in the aerospace industry and have worked at TRW, Special Devices Inc., and Pacific Scientific Energetic Materials Company. I am very familiar with the technology associated with rocket motors, pyrotechnics, and electronics used for operating ordnance systems. Since 1999, I have been in charge of product development, first at Special Devices Inc. and then at Pacific Scientific, in the aerospace field.

3. I understand that the Office Action objects to the specification of my patent application as failing to enable one having ordinary skill in the art to make or use the disclosed

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invention because it allegedly "does not make clear the two conditions known as the analog condition and the firing condition." Additionally, the Office Action rejects claims 66, 67, and 90-100 as failing to comply with the enablement requirement. I disagree with this objection and rejection, and respectfully request reconsideration in light of the remarks provided herein.

4. As acknowledged in the Office Action, page 19 (ll. 5-10) of the specification clearly provides that:

The analog condition of the cable network 204 is preferably a characteristic of the electrical power transmitted across that cable network 204. By way of example and not limitation, the analog condition of the cable network 204 may be voltage level on the cable network 204, modulation depth, or frequency.

5. Page 19 (ll. 1-5) of the specification also provides that this condition can be altered by the bus controller 206 or by other devices electrically connected to the pyrotechnic system 200. For example, the analog condition can be altered by altering the voltage level of signals transmitted along the bus.

6. Prior to the claimed invention, it was known that the analog condition of a bus could be altered. For example, Boucher discloses a system in which the arming signal is transmitted at a higher voltage than communication signals. Therefore, the bus is in a different analog condition when a communication signal is transmitted as compared to the analog condition when an arm signal is transmitted.

7. More particularly, Boucher's communications signals are at a voltage that is lower than the no-fire threshold of the initiators. As Boucher describes, "in this way, test and programming signals that are not intended themselves to arm and/or initiate the initiator are carried

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out at a level that is insufficient to arm and/or initiate the initiators even if the communication signals are somehow misinterpreted." (Boucher, 11: 1-5.)

8. Unfortunately, such an arrangement does not provide adequate safety and provides a suboptimal result. In Boucher, a communications signal is transmitted at a voltage that by itself is too low to sufficiently charge a firing capacitor. But, if the firing capacitor is already nearly charged, the low voltage communication signal could cause the pyrotechnic device to accidentally arm or fire.

9. The claimed invention solves this problem by adding an additional requirement beyond the known use of an arming signal and a firing signal. As described in the specification, "in a preferred embodiment, for an armed pyrotechnic device to fire, it must receive a digital firing command and sense proper analog conditions on the cable network 204" so that "both digital and analog fire control conditions must be met before the pyrotechnic device can be fired." (Page 18, ll. 18-21.)

10. This is accomplished by configuring the pyrotechnic device so that it can only fire if both (1) a digital firing signal is recognized by the logic device and (2) the logic device determines that the bus interface senses the analog condition corresponding to the firing command. (Page 20, ll. 10-11.)

11. The claimed invention provides a significant improvement over conventional systems because it utilizes both the logic device and the bus interface to ensure that it is intended for the pyrotechnic device to initiate. The logic device decodes a digital arming command and a digital

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firing command. If the bus interface senses that the analog condition is altered, then the logic device closes a circuit between the energy reserve capacitor and the initiator. Without all of these measures – (i) the digital arming command, (ii) the digital firing command, and (iii) determination that the analog condition corresponds to the firing command – the pyrotechnic device does not fire.

12. Apparently, the confusion seems to stem from the sentence that reads "[p]referably, the bus controller 206 alters the analog condition of the cable network 204 to a firing condition." (Page 19, ll. 2-3) The Office Action interprets this sentence to mean that the "analog condition" somehow disappears and morphs into a "firing condition." However, this is not how one of ordinary skill in the art at the time of the invention would have interpreted this. Taking the specification as a whole, one of ordinary skill in the art at the time of the invention would have understood this to disclose that the analog condition of the bus is altered *so as to place the bus into* a condition required for firing. In that regard, an analog condition is established that corresponds to the firing command, and the pyrotechnic device is configured so as to fire only upon receiving the firing command and sensing the analog condition corresponding to the firing command.

13. An electronics technician skilled in the art at the time of the invention would know how to change a voltage, modulation depth, or frequency of a network to alter an analog condition of the network. Additionally, the technician would know how to sense that an analog condition of the network has been altered. An aspect of the claimed invention is directed to utilizing this technology as a critical safety measure for determining whether a pyrotechnic device should respond to a firing command. Based on the disclosure in the specification, one of ordinary skill in the art at the time of the invention would have been enabled to make and/or use the invention.

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14. Claim 101 of the pending application is directed to a networked electronic ordnance system including a logic device having a unique identifier that stores activation energy upon receiving a digital arming command that includes its unique identifier, and (A) releases the stored activation energy into its initiator when a digital firing command is received that includes its unique identifier, and (B) discharges the stored activation energy when a digital disarming command is received that includes its unique identifier.


15. None of the references in the Office Action discloses a digital disarm command with a unique identifier. It is this component that enables the claimed system to selectively disarm certain networked pyrotechnic devices while leaving other networked pyrotechnic devices armed. This functionality provides significant advantages in aerospace applications, particularly for missiles.

16. The assignee of the pending patent application, PS/EMC West LLC, commercializes the claimed technology as the Smart Energetics Architecture (SEA™). The SEA technology has enjoyed tremendous success and acclaim directly as a result of improvements to the state of the art as discussed above.

Date:

8/27/07

Respectfully submitted,


Steven D. Nelson
Inventor

VII. RELATED PROCEEDINGS INDEX

[None]
